TFT LCD Approval Specification

Model NO.: A260J1- 001

Customer :_____

Approved by : _____

Note :

Liquid Crystal Display Division	
QRA Division	OA Head Division
Approval	Approval

- CONTENTS -

REVISION HISTORY

Version	Date	Section	Description
Ver 3.0	Jan.17. 08’	-	A260J1 -001 Approval specifications was first issued.
	,	-	
		-	

1. GENERAL DESCRIPTION

1.1 OVERVIEW

A260J1-001 is a 25.54" TFT Liquid Crystal Display module with 12 CCFL Backlight unit and 30 pins 2ch-LVDS interface. This module supports 1920 x 1200 WUXGA mode and can display up to 16.7M colors. The inverter module for Backlight is not built in.

1.2 FEATURES

- Extra-wide viewing angle.
- High contrast ratio.
- Fast response time.
- High color saturation.
- WUXGA (1920 x 1200 pixels) resolution.
- DE (Data Enable) only mode.
- LVDS (Low Voltage Differential Signaling) interface.
- RoHS compliance.
- TCO'03 compliance.

1.3 APPLICATION

- TFT LCD Monitor

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	550.08 (H) x 343.8 (V) (25.54" diagonal)	mm	(1)
Bezel Opening Area	554.1 (H) x 347.8 (V)	mm	
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1200	pixel	-
Pixel Pitch	0.2865 (H) x 0.2865 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally White	-	-
Surface Treatment	AG type, 3H hard coating, Haze 25	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	581.5	582.0	582.5	mm	(1)
	Vertical(V)	375.1	375.6	376.1	mm	
	Depth(D)	36.7	37.2	37.7	mm	
Weight		-	-	3000	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	40	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

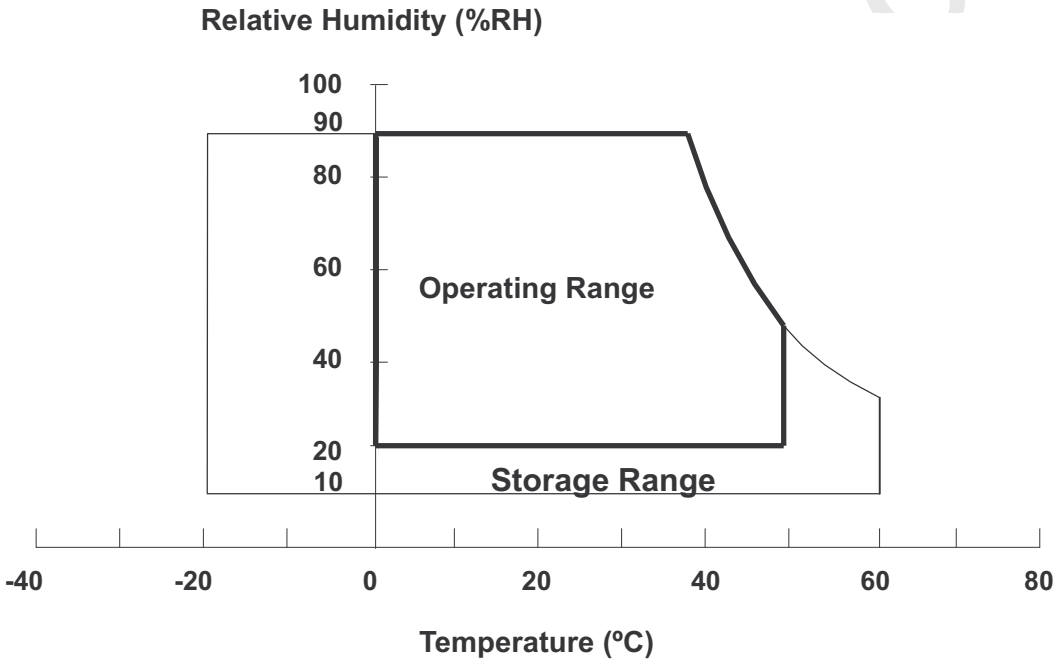
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 ºC Min. and 60 ºC Max.

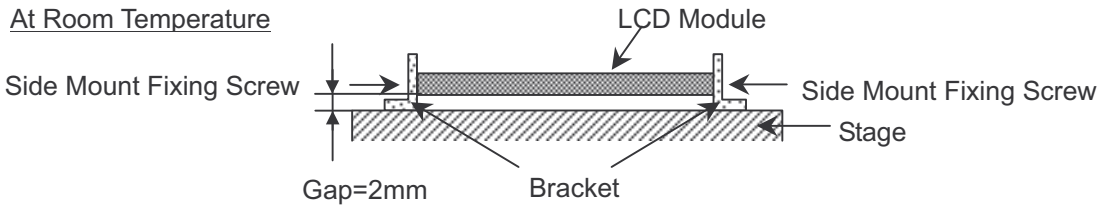


Note (3) 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.

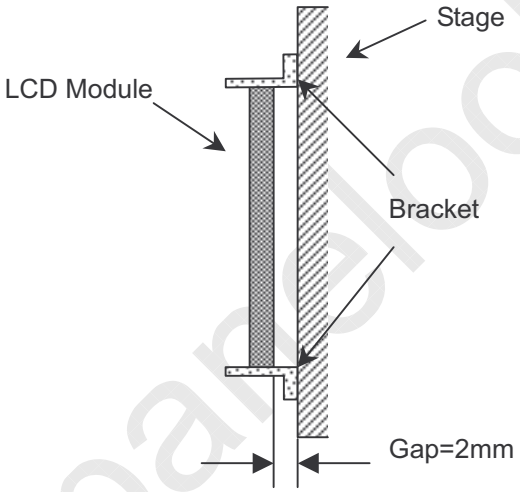
Note (4) 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



X Direction



Y Direction

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	+6.0	V	(1)

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	932	1140	V_{RMS}	(1), (2)
Lamp Current	I_L	4.5	5.5	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	48	70	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

Parameter	SYMBOL	Value			UNIT	Note
		MIN	TYP	MAX		
Power Supply Voltage for LCD	Vin	2.97	3.3	3.63	V	-
Power Supply Current for LCD	Iin	-	1000	-	mA	-
Differential Impendence	Zm	-	100	-	Ω	-
LCD Inrush Current	Irush	-	3	-	A	-
VCOM Voltage	VCM	4.3		6.3	V	(1)
VSA Voltage	VAA	12.4	12.7	13	V	
VGL Voltage	VGL	-5.3	-5.5	-5.7	V	
VGH Voltage	VGH	22.6	23.2	23.8	V	
Gamma 1	GMA1	11.41	11.56	11.71	V	
Gamma 2	GMA2	10.705	10.855	11.005	V	
Gamma 3	GMA3	8.994	9.005	9.105	V	
Gamma 4	GMA4	8.468	8.568	8.668	V	
Gamma 5	GMA5	8.183	8.283	8.383	V	
Gamma 6	GMA6	6.75	6.85	6.95	V	
Gamma 7	GMA7	6.35	6.45	6.55	V	
Gamma 8	GMA8	6.07	6.17	6.27	V	
Gamma 9	GMA9	5.7	5.8	5.9	V	
Gamma 10	GMA10	4.097	4.197	4.297	V	
Gamma 11	GMA11	3.672	3.772	3.872	V	
Gamma 12	GMA12	3.115	3.215	3.315	V	
Gamma 13	GMA13	1.145	1.245	1.345	V	
Gamma 14	GMA14	0.096	0.116	0.136	V	

Note (1) VCOM Adjustable Range 4.3~6.3V

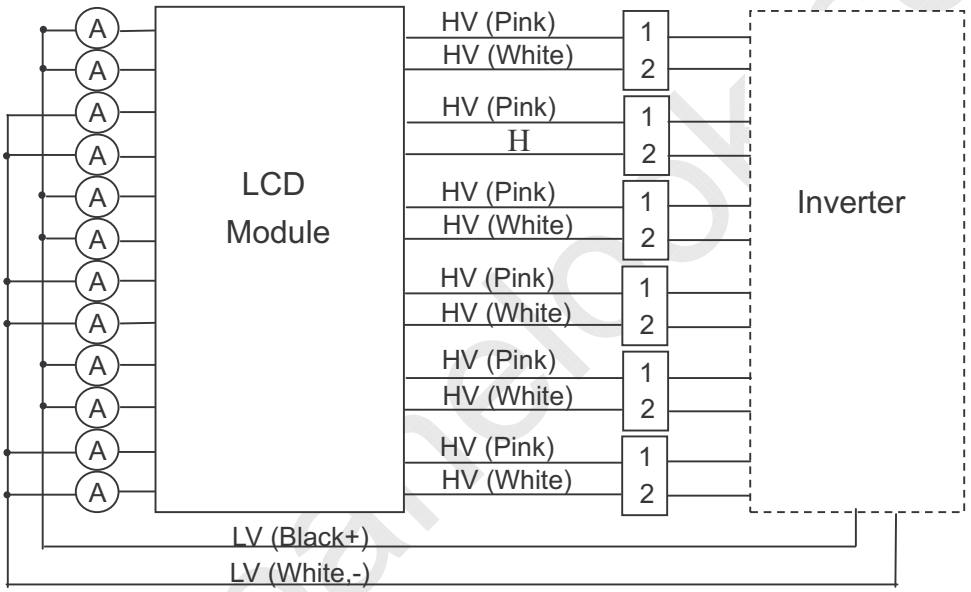
3.2 BACKLIGHT UNIT

3.2.1CCFL CHARACTERISTICS

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	932	1036	1140	V_{RMS}	I_L = 5.0 mA
Lamp Current	I_L	4.5	5.0	5.5	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S			1920 (0℃)	V_{RMS}	(2)
				1620 (25℃)	V_{RMS}	(2)
Operating Frequency	F_L	48	55	70	KHz	(3)
Lamp Life Time	L_{BL}	50,000			Hrs	(5), I_L = 5.0mA

Note (1) Lamp current is measured by current amplify & oscilloscope as shown below:



Note (2) The voltage that must be larger than Vs should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note (3) The lamp frequency may produce interference with horizontal synchronization frequency from the display, which might cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronization frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L \times 12$

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ±2 °C and I_L = 5.0 mArms until one of the following events occurs:

(a) When the brightness becomes or lower than 50% of its original value.

(b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

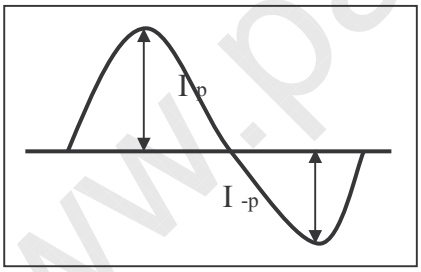
The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;

c. The ideal sine wave form shall be symmetric in positive and negative polarities



* Asymmetry rate:

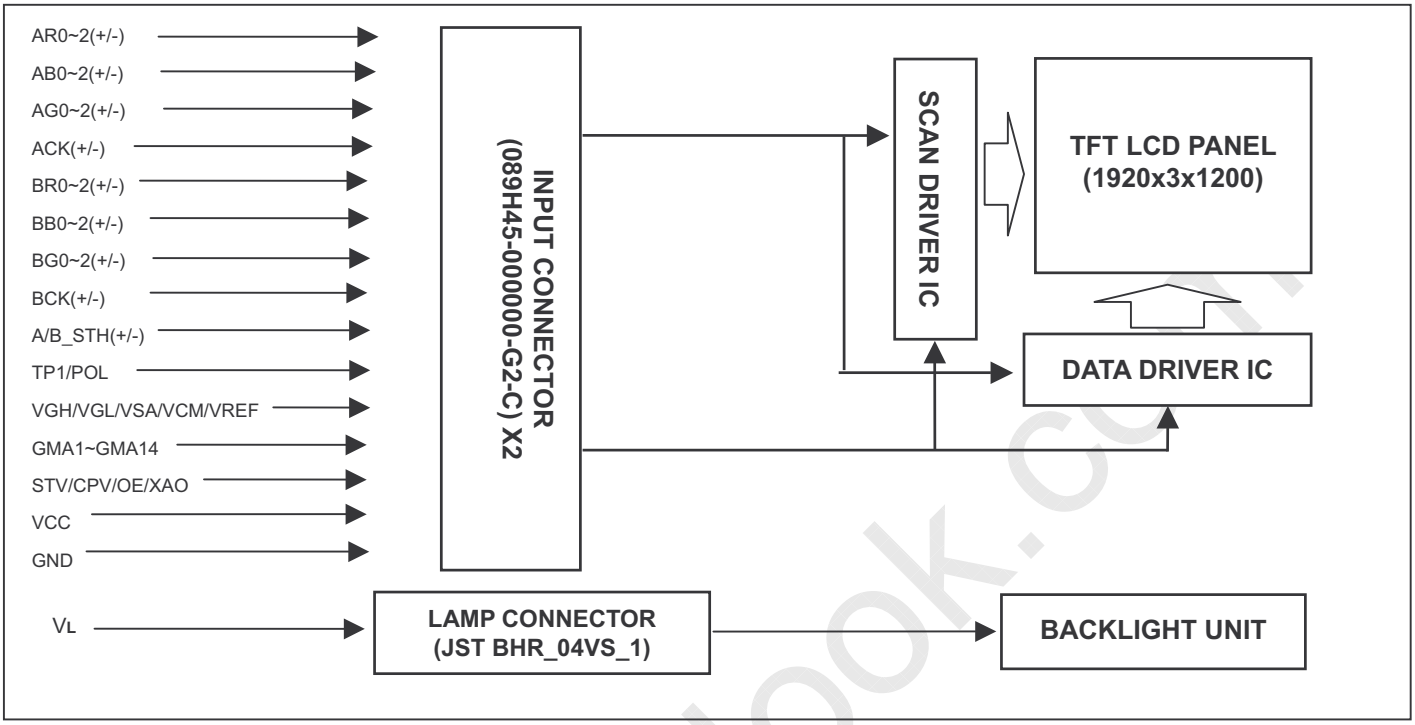
$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

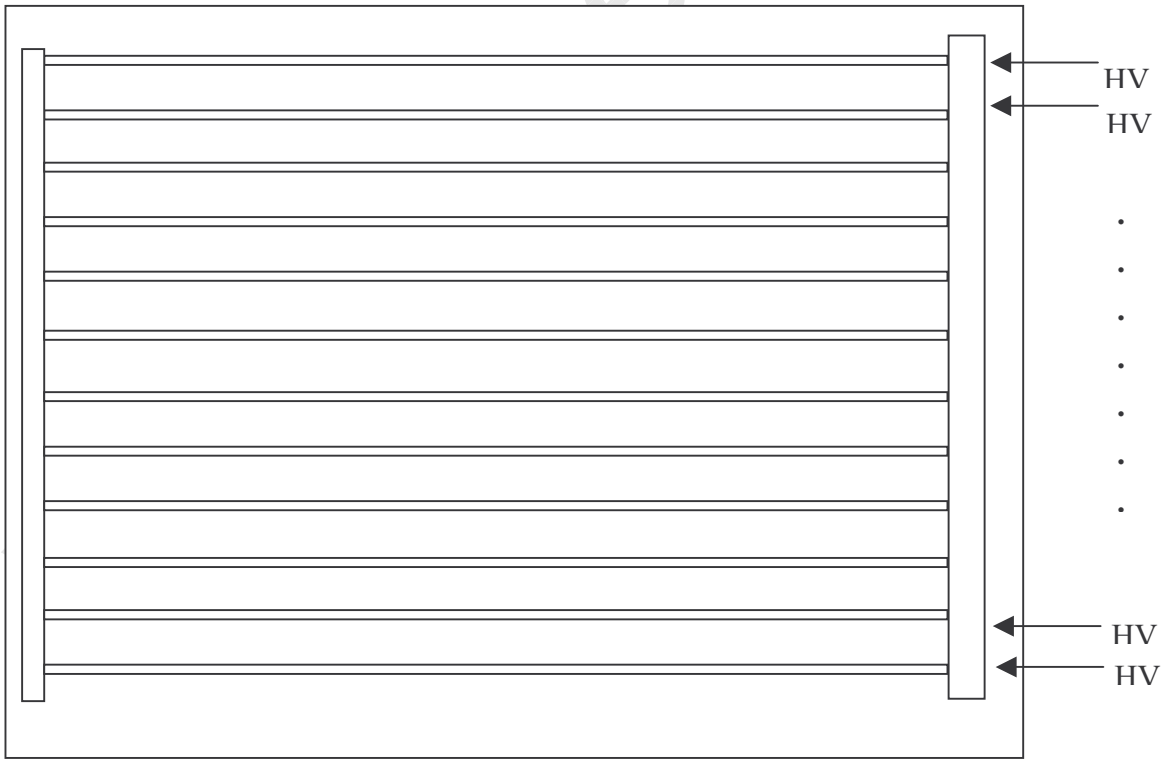
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



Note. On the same side, the same-polarity lamp voltage design for lamps is recommended.

5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

CN1 :

Pin	Name	Description
1	B_B2P	Positive RSDS differential data input. Channel B2(Back)
2	B_B2N	Negative RSDS differential data input. Channel B2(Back)
3	B_B1P	Positive RSDS differential data input. Channel B1(Back)
4	B_B1N	Negative RSDS differential data input. Channel B1(Back)
5	B_B0P	Positive RSDS differential data input. Channel B0(Back)
6	B_B0N	Negative RSDS differential data input. Channel B0(Back)
7	GND	Ground
8	B_G2P	Positive RSDS differential data input. Channel G2(Back)
9	B_G2N	Negative RSDS differential data input. Channel G2(Back)
10	B_G1P	Positive RSDS differential data input. Channel G1(Back)
11	B_G1N	Negative RSDS differential data input. Channel G1(Back)
12	B_G0P	Positive RSDS differential data input. Channel G0(Back)
13	B_G0N	Negative RSDS differential data input. Channel R0(Back)
14	GND	Ground
15	B_CKP	Positive RSDS differential clock input. (Back)
16	B_CKN	Negative RSDS differential clock input. (Back)
17	GND	Ground
18	B_R2P	Positive RSDS differential data input. Channel R2(Back)
19	B_R2N	Negative RSDS differential data input. Channel R2(Back)
20	B_R1P	Positive RSDS differential data input. Channel R1(Back)
21	B_R1N	Negative RSDS differential data input. Channel R1(Back)
22	B_R0P	Positive RSDS differential data input. Channel R0(Back)
23	B_R0N	Negative RSDS differential data input. Channel R0(Back)
24	B_STH	Data driver start pulse input(Back)
25	NC	No define
26	VSA	VAA Power input
27	VSA	
28	VSA	
29	GMA14	Gamma 14 Voltage input
30	GMA13	Gamma 13 Voltage input
31	GMA12	Gamma 12 Voltage input
32	GMA11	Gamma 11 Voltage input
33	GMA10	Gamma 10 Voltage input
34	GMA9	Gamma 9 Voltage input
35	GMA8	Gamma 8 Voltage input
36	VCC	Power Supply Voltage input
37	VCC	
38	VCC	
39	GMA7	Gamma 7 Voltage input
40	GMA6	Gamma 6 Voltage input
41	GMA5	Gamma 5 Voltage input
42	GMA4	Gamma 4 Voltage input
43	GMA3	Gamma 3 Voltage input
44	GMA2	Gamma 2 Voltage input
45	GMA1	Gamma 1 Voltage input

CN2：

Pin	Name	Description
1	GND	Ground
2	A_B2P	Positive RSDS differential data input. Channel B2(Front)
3	A_B2N	Negative RSDS differential data input. Channel B2(Front)
4	A_B1P	Positive RSDS differential data input. Channel B1(Front)
5	A_B1N	Negative RSDS differential data input. Channel B1(Front)
6	A_B0P	Positive RSDS differential data input. Channel B0(Front)
7	A_B0N	Negative RSDS differential data input. Channel B0(Front)
8	GND	Ground
9	A_G2P	Positive RSDS differential data input. Channel G2(Front)
10	A_G2N	Negative RSDS differential data input. Channel G2(Front)
11	A_G1P	Positive RSDS differential data input. Channel G1(Front)
12	A_G1N	Negative RSDS differential data input. Channel G1(Front)
13	A_G0P	Positive RSDS differential data input. Channel G0(Front)
14	A_G0N	Negative RSDS differential data input. Channel G0(Front)
15	GND	Ground
16	A_CKP	Positive RSDS differential clock input. (Front)
17	A_CKN	Negative RSDS differential clock input. (Front)
18	GND	Ground
19	TP1	The contents of the data driver register are transferred to the latch circuit at the rising edge of TP1. Then the gray scale voltage is output from the device at the falling edge of TP1
20	POL	Data driver polarity inverting input
21	GND	Ground
22	A_R2P	Positive RSDS differential data input. Channel R2(Front)
23	A_R2N	Negative RSDS differential data input. Channel R2(Front)
24	A_R1P	Positive RSDS differential data input. Channel R1(Front)
25	A_R1N	Negative RSDS differential data input. Channel R1(Front)
26	A_R0P	Positive RSDS differential data input. Channel R0(Front)
27	A_R0N	Negative RSDS differential data input. Channel R0(Front)
28	GND	Ground
29	A_STH	Data driver start pulse input(Front)
30	VREF	Gamma Reference Voltage input
31	VREF	
32	VREF	
33	GND	Ground
34	VGH	Power supply for Gate on output
35	VGH	
36	VGH	
37	VCM	This pin is used to generate common voltage input for panel
38	VCM	
39	VGL	Power supply for Gate on output
40	VGL	
41	GND	Ground
42	STV	Gate driver start pulse is read at the rising edge of CKV and a scan signal is output from the gate driver output pin.
43	CPV	Gate driver shift clock
44	OE	This pin is used to control the Gate driver output. When OE input is “H”, gate driver output is fixed to VGL level regardless CPV.
45	XAO	Output all-on control

Note (1) Connector Part No.: 089H45-000000-G2-C

5.2 BACKLIGHT UNIT:

Pin	Symbol	Description	Remark
1-1	HV	High Voltage	Pink
1-2	HV	High Voltage	White
2-3	HV	High Voltage	Pink
2-4	HV	High Voltage	White
3-5	HV	High Voltage	Pink
3-6	HV	High Voltage	White
4-7	HV	High Voltage	Pink
4-8	HV	High Voltage	White
5-9	HV	High Voltage	Pink
5-10	HV	High Voltage	White
6-11	HV	High Voltage	Pink
6-12	HV	High Voltage	White

Note (1) Connector Part No.: YEONHO 20015HS-04LB or equivalent

5.3 COLOR DATA INPUT ASSIGNMENT

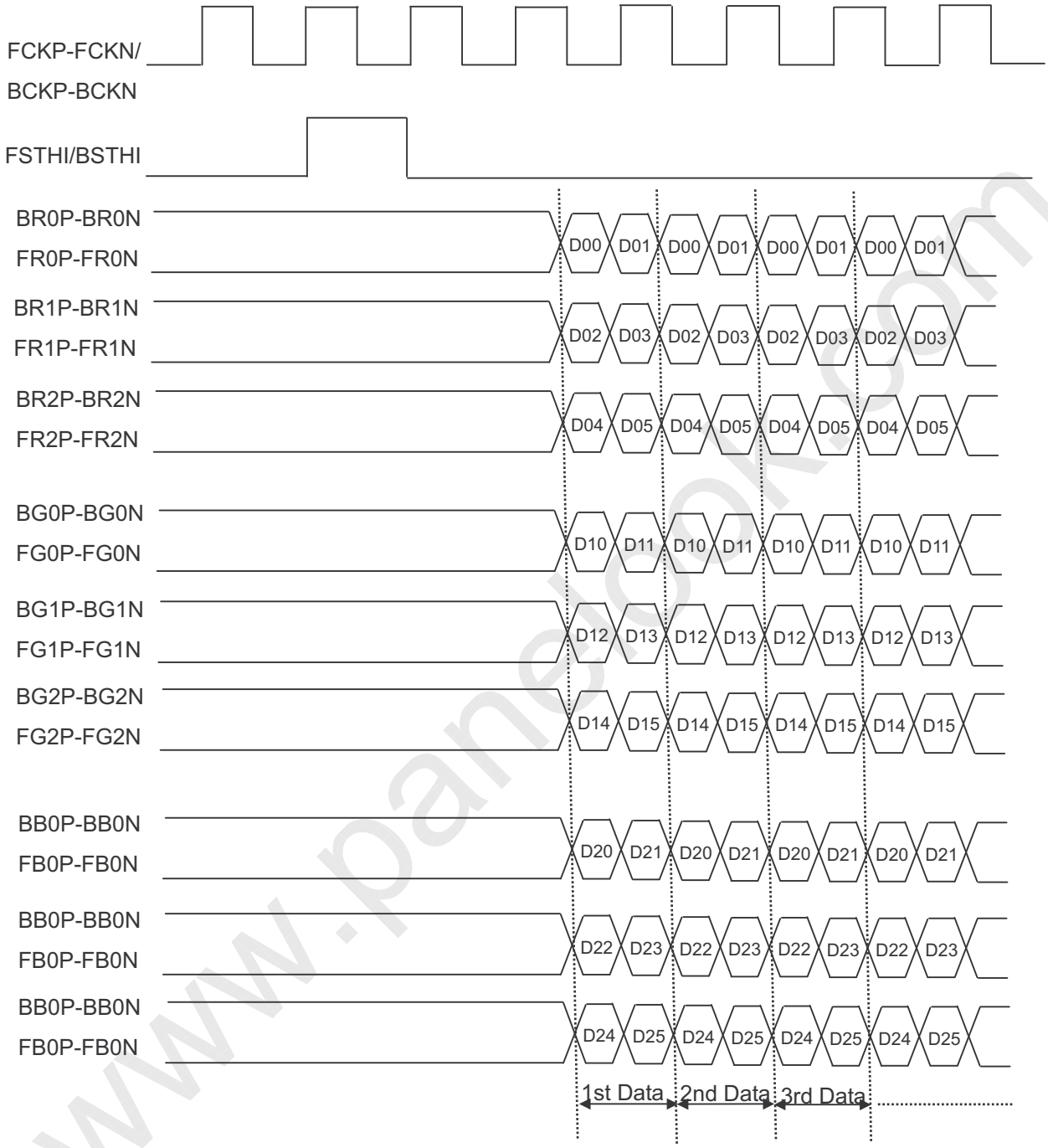
The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

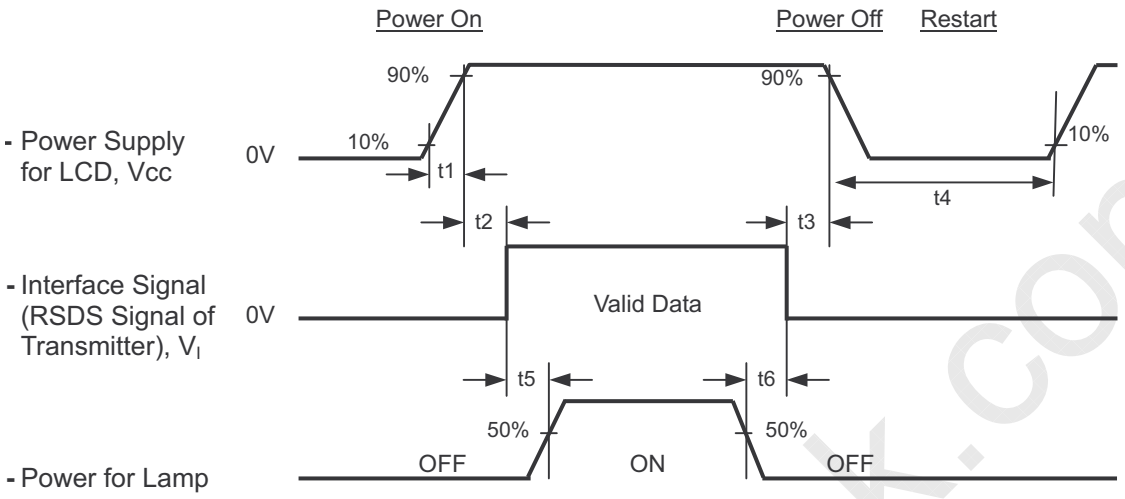
6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Timing Specifications:

0.5< t1 ≦ 10 msec

0 < t2 ≦ 50 msec

0 < t3 ≦ 50 msec

t4 ≧ 500 msec

t5 ≧ 500 msec

t6 ≧ 90 msec

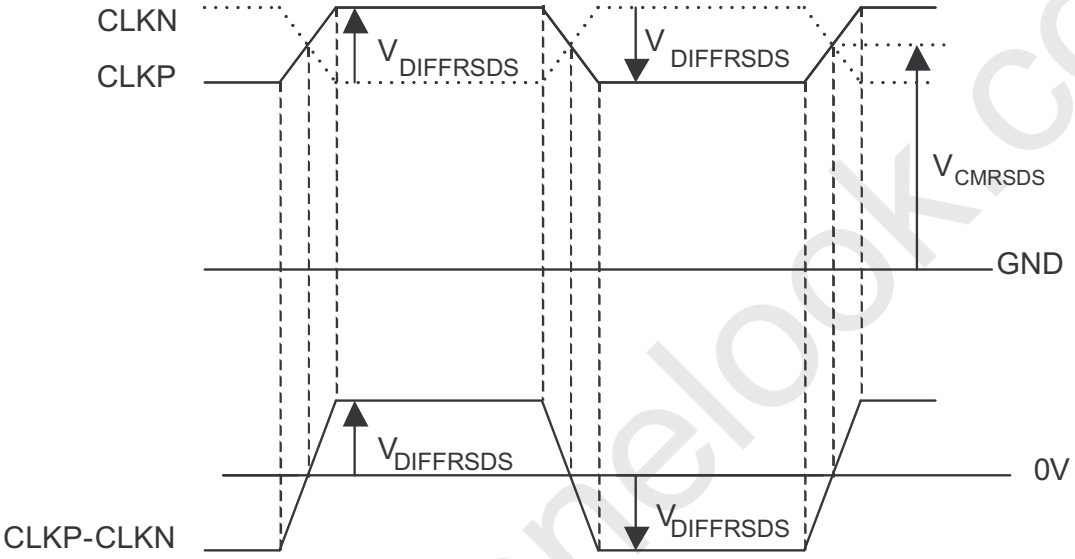
7. Driver DC CHARACTERISTICS

7.1 RSDS CHARACTERISTICS (VDD = 2.3 to 3.6 V, VDDA = 8.0 to 13.5 V, VSSD = VSSA = 0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
RSDS high input voltage	$V_{DIFFRSDS}$	V_{CMRSDS} = + 1.2 V (1)	100	200	-	mV
RSDS low input voltage	$V_{DIFFRSDS}$	V_{CMRSDS} = + 1.2 V (1)	-	-200	- 100	
RSDS common mode input voltage range	V_{CMRSDS}	$V_{DIFFRSDS}$ = + 200 mV (2)	VSSD + 0.1	-	VDDD - 1.2	V
RSDS input leakage current	IDL	DxxP, DxxN, CLKP, CLKN	-10	-	10	μA

Note: (1) VCMRSDS = (VCLKP + VCLKN) / 2 or VCMRSDS = (VDxxP + VDxxN) / 2

(2) VDIFFRSDS = VCLKP - VCLKN or VDIFFRSDS = VDxxP – VDxxN



7.2 ELECTRICAL CHARACTERISTICS (VSSD=VSSA=0V)

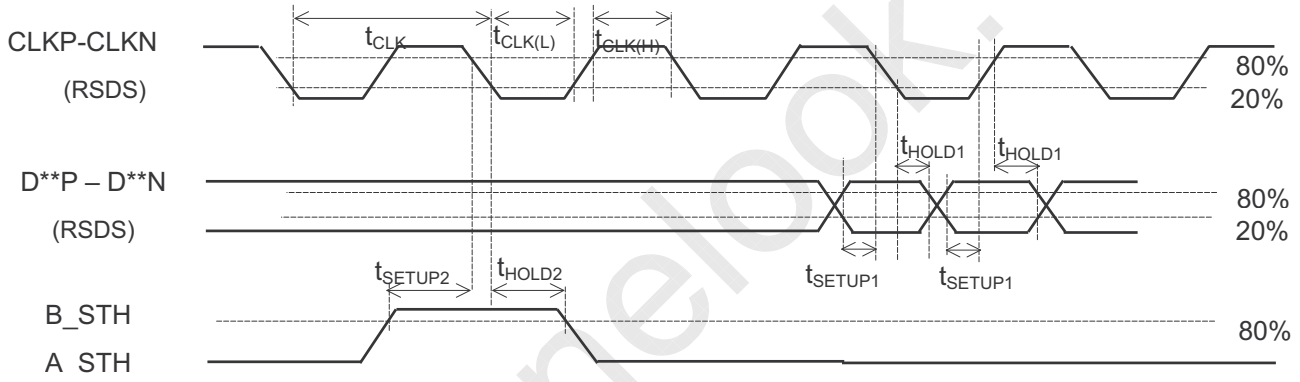
Parameter	Symbol	Condition	Spec			Unit
			Min.	Typ.	Max.	
RSDS input “Low” Voltage	$V_{DIFFRSDS}$	DX[2:0]P,DX[2:0]N, CLKP,CLKN	-	-200	-	mV
RSDS input “High” Voltage	$V_{DIFFRSDS}$		-	200	-	mV
RSDS reference voltage	V_{CMRSDS}		VSSD+0.1	1.2	VDDD-1.2	V
Input “Low” voltage	V_{IL}	EIO1,EIO2,DIR,TP1, POL	0	-	0.2VDDD	μA
Input “High” voltage	V_{IH}		0.8VDDD	-	VDDD	μA
Input leak current	IL		-1	-	1	μA
Supply current (In operation mode)	I_{CCD1}	VDDD=3.6V	-	-	Note(1)	mA
Supply current (In stand-by mode)	I_{CCD2}	VDDD=3.6V	-	-	Note(2)	mA
Pull high resistance	Rpu	/POLINV,RS, ENREOP,VC	0.9Typ	800	1.1Typ	kΩ
Pull low resistance	Rpd	POL20,/LP	0.9Typ	190	1.1Typ	kΩ

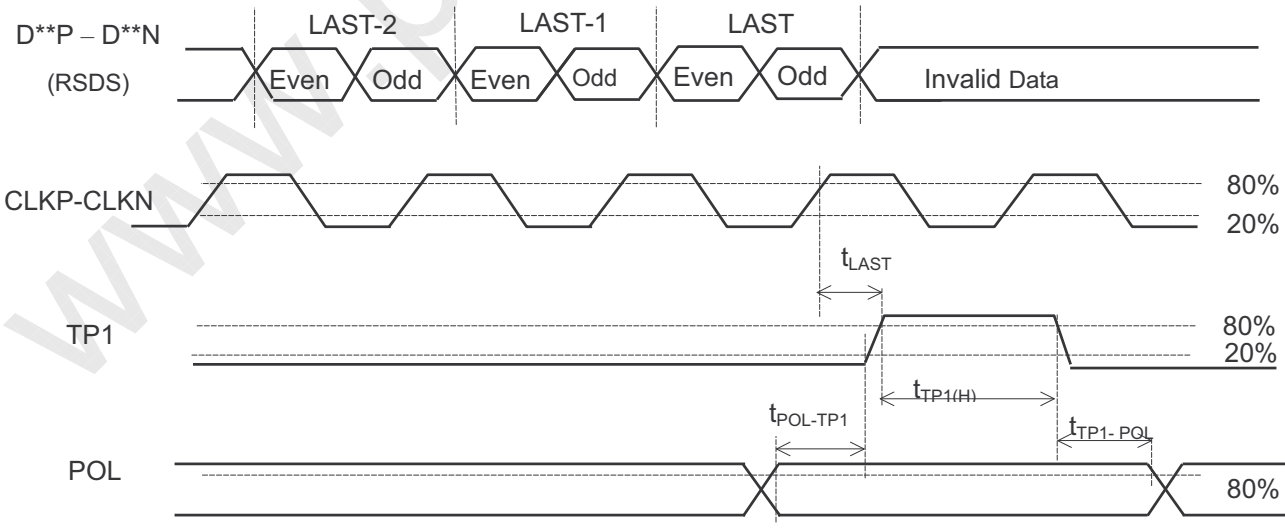
Note: (1) Test condition: TP1= 20μs, CLK =54MHz, data pattern =1010….checkerboard pattern, Ta=25℃

(2) No load condition

8. Driver AC CHARACTERISTICS

Parameter	Symbol	Condition	Spec			Unit
			Min.	Typ.	Max.	
Clock pulse width	t_{CLK}	-	11	-	-	ns
Clock pulse low period	$t_{CLK(L)}$	-	5	-	-	ns
Clock pulse high period	$t_{CLK(H)}$	-	5	-	-	ns
Data setup time	t_{SETUP1}	-	2	-	-	ns
Data hold time	t_{HOLD1}	-	0	-	-	ns
Start pulse setup time	t_{SETUP2}	-	1	-	-	ns
Start pulse hold time	t_{HOLD2}	-	2	-	-	ns
TP1 high period	$t_{TP1(H)}$	-	15	-	-	CLKP
Last data CLK to TP1 high	t_{LAST}	-	0	-	-	CLKP
TP1 high to EIOn high	t_{NEXT}	-	6	-	-	CLKP
POL to TP1 setup time	$t_{POL-TP1}$	POL toggle to TP1 rising	3	-	-	ns
TP1 to POL hold time	$t_{TP1-POL}$	TP1 falling to POL toggle	2	-	-	ns

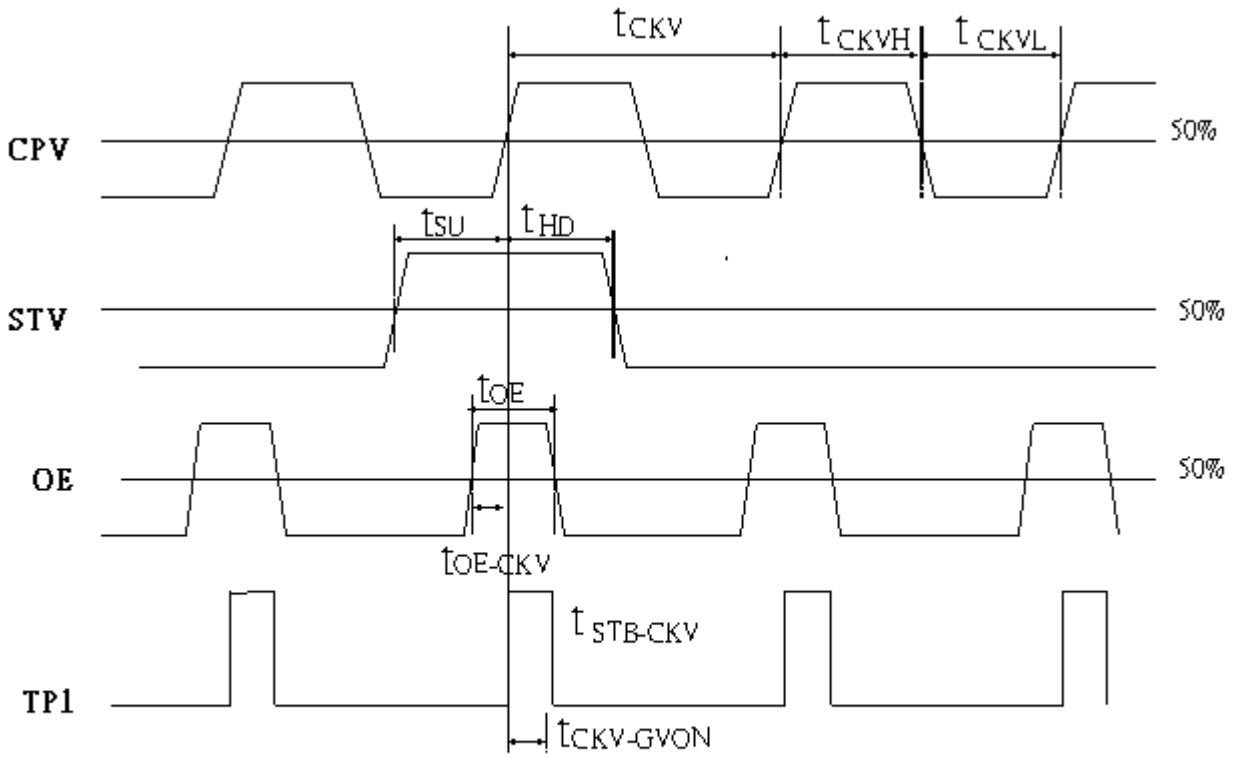




9. VERTICAL TIMING

Parameter	Symbol	Condition	Spec			Unit
			Min.	Typ.	Max.	
CPV period	t_{CKV}	-	5	-	-	μs
CPV pulse width	t_{CKVH}, t_{CKVL}	50% duty cycle	2.5	-	-	
OE pulse width	t_{OE}	-	1	-	-	
/XAO pulse width	t_{WXAO}	-	6	-	-	
Data setup time	t_{SU}	-	0.7	-	-	μs
Data hold time	t_{HD}	-	0.7	-	-	μs
OE to CPV time	t_{OE-CKV}	-	-	0.5	-	μs
TP1 to CPV	$t_{STB-CKV}$	-	0	0	0	μs
TP1 Pulse Width	t_{STB}	-	-	0.5	-	μs

Note 1: OE, STB frequency same as CPV



10. OPTICAL CHARACTERISTICS

10.1 TEST CONDITIONS

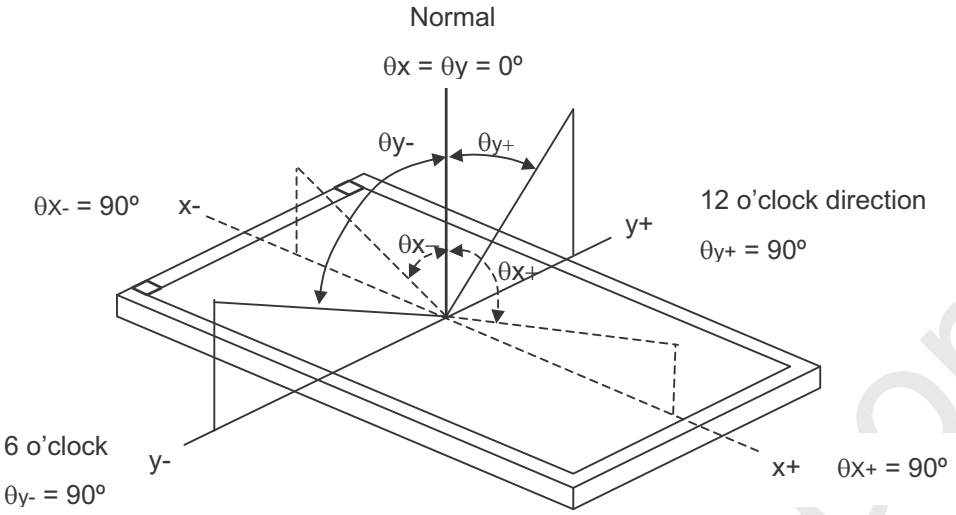
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	5V	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I_L	5.0	mA
Inverter Operating Frequency	F_L	58±2	KHz
Inverter	CMO 4H.V2281.011/D 27D-D016512		

10.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 10.2. The following items should be measured under the test conditions described in 10.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	θ_x=0°, θ_Y =0° CS-1000T	Typ - 0.03	0.645	Typ + 0.03	-	(1), (5)
		Ry			0.335			
	Green	Gx			0.281			
		Gy			0.610			
	Blue	Bx			0.150			
		By			0.070			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White (Center of Screen)		L_C		250	350	-	cd/m^2	(4), (5)
Contrast Ratio		CR		500	750	-	-	(2), (5)
Response Time		T_R	θ_x=0°, θ_Y =0°	-	1		ms	(3)
		T_F		-	4			
White Variation		δW	θ_x=0°, θ_Y =0° USB2000	-	1.2	1.5	-	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10 USB2000	75	85	-	Deg.	(1), (5)
		θ_x-		75	85	-		
	Vertical	θ_Y+		70	80	-		
		θ_Y-		60	80	-		

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

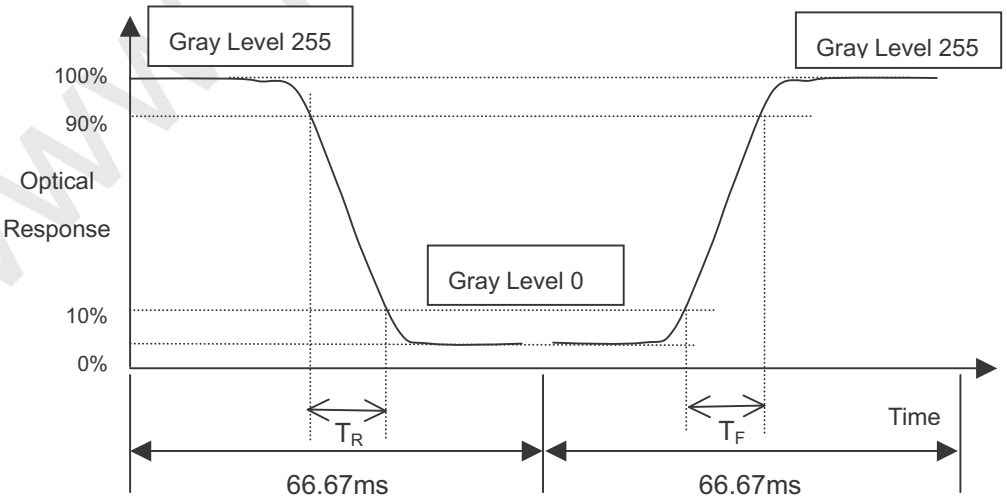
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



Note (4) Definition of Luminance of White (L_C):

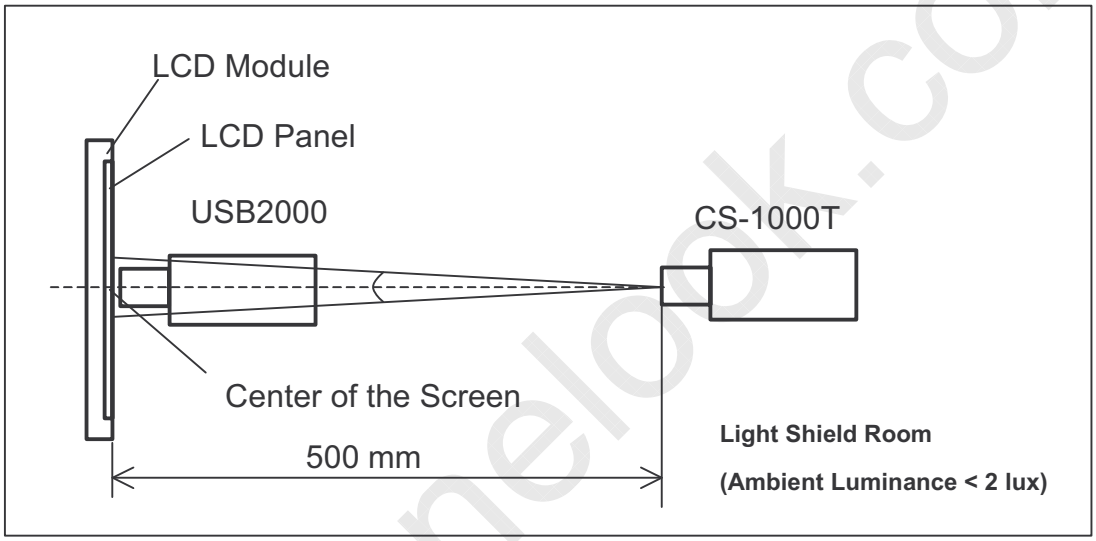
Measure the luminance of gray level 255 at center point

$L_C = L (1)$

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

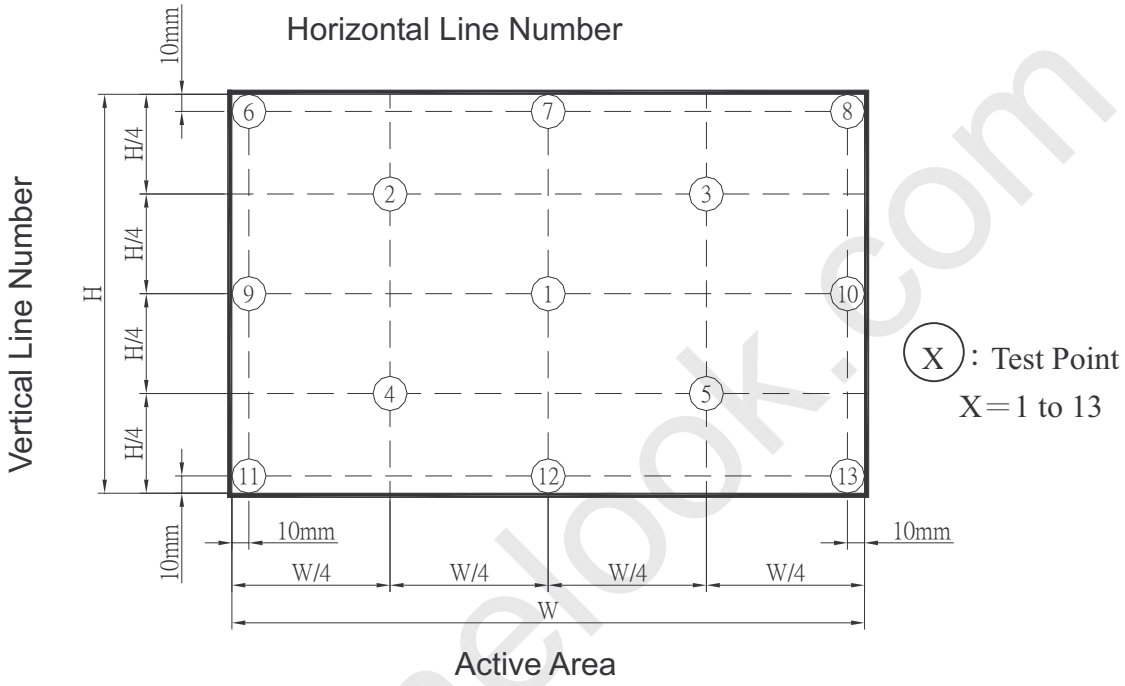
The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 13 points

$$\delta W = \frac{\text{Maximum [L(1), L(2), L(3), L(4), L(5), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}{\text{Minimum [L(1), L(2), L(3), L(4), L(5), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}$$



11. PACKAGING

11.1 PACKING SPECIFICATIONS

(1) 5 LCD modules / 1 Box

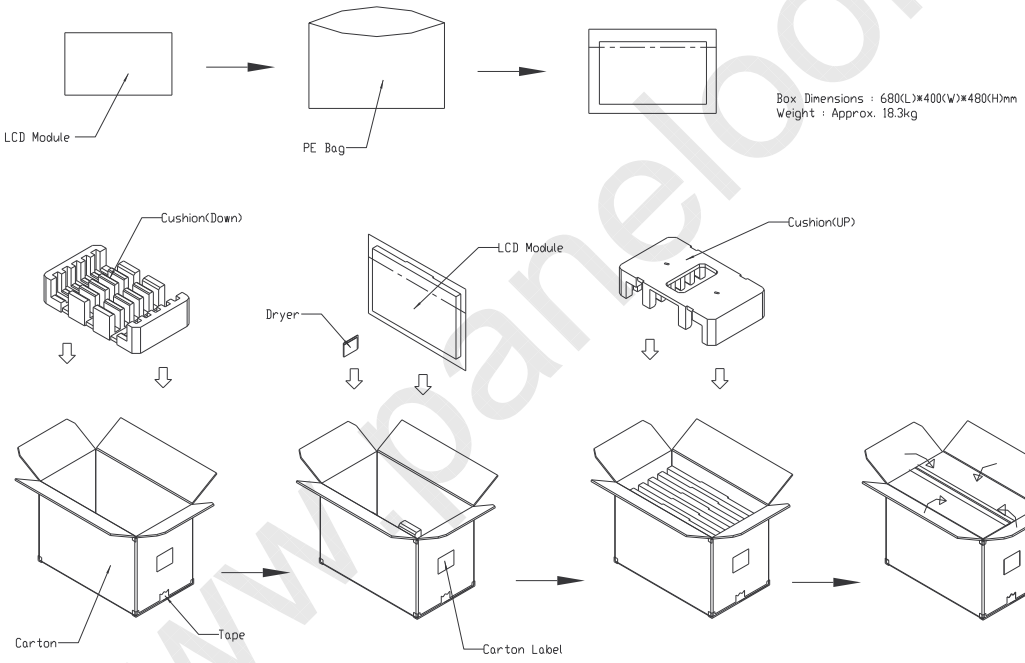
(2) Box dimensions: 680(L) X 400(W) X 480(H) mm

(3) Weight: approximately 18.3Kg (5 modules per box)

11.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation



For ocean shipping

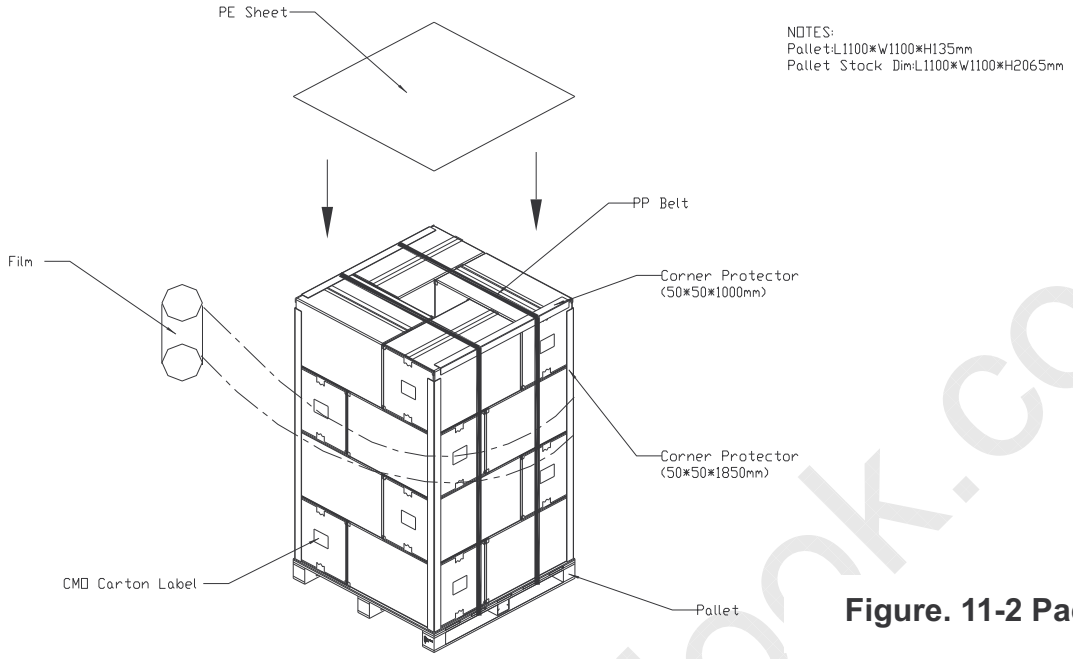


Figure. 11-2 Packing method

For air transport

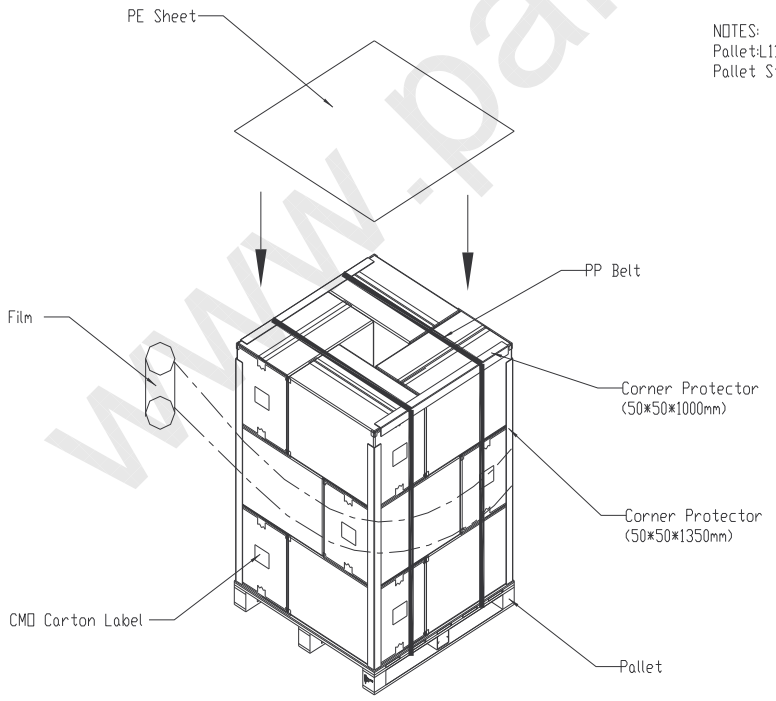


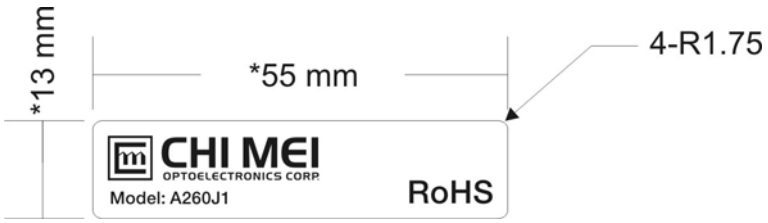
Figure. 11-3 Packing method

12. DEFINITION OF LABELS

12.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) GP label



(b) S/N label:

1. Model Name: A260J1-001
2. Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.
3. CMO barcode definition:

   Serial ID: XX-XX-X-XX-XXX-X-XXXX

Code	Meaning	Description
XX	CMO internal use	-
XX	Revision	Cover all the change
X	CMO internal use	-
XX	CMO internal use	-
XXX	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4… Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U.
X	Product line #	Line 1=1, Line 2=2, Line 3=3, …
XXXX	Serial number	Manufacturing sequence of product

13. PRECAUTIONS

13.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

(5) Do not pull the I/F connector in or out while the module is operating.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(10) When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

13.2 SAFETY PRECAUTIONS

(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.

14.MECHANICAL CHARACTERISTICS